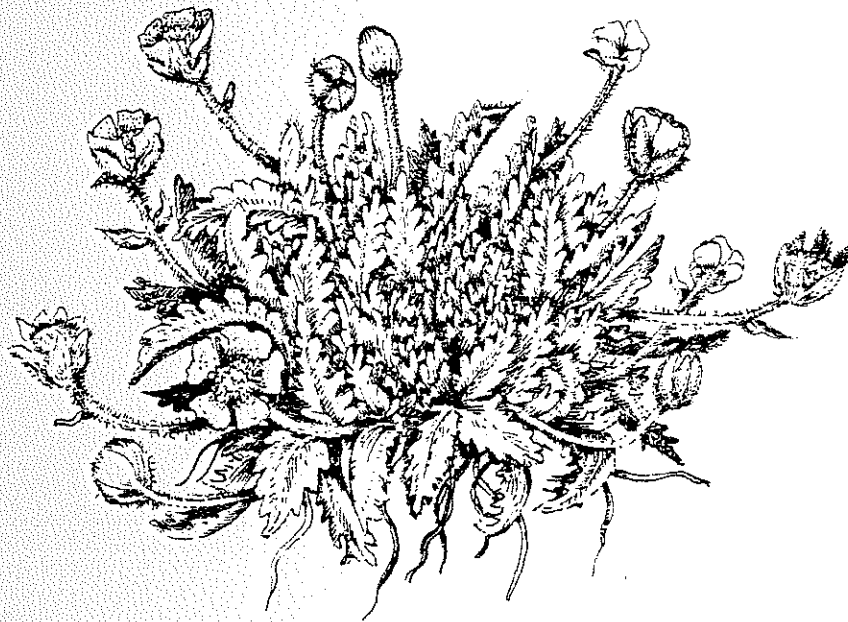


ROBBINS' CINQUEFOIL

Potentilla robbinsiana

RECOVERY PLAN



Prepared by

Region Five

U.S. Fish and Wildlife Service
and

U.S. Forest Service
White Mountain National Forest



APRIL 1983

37 pp.

ROBBINS' CINQUEFOIL

RECOVERY PLAN

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This is the completed Robbins' Cinquefoil Recovery Plan. It has been approved by the U.S. Fish and Wildlife Service. It does not necessarily represent official positions or approvals of cooperating agencies (and it does not necessarily represent the views of all recovery team members/individuals), who played the key role in preparing this plan. This plan is subject to modification as dictated by new findings and changes in species status and completion of tasks described in the plan. Goals and objectives will be attained and funds expended contingent upon appropriations, priorities, and other budgetary constraints.

Acknowledgements should read as follows:

The Robbins' Cinquefoil Recovery Plan, dated April 1983 prepared by the U.S. Fish and Wildlife Service and the U.S. Forest Service, White Mountain National Forest.

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PART 1

INTRODUCTION

Robbins' cinquefoil (Potentilla robbinsiana Oakes) is a plant occurring only in New Hampshire between Mt. Monroe and Mt. Washington on land administered by the U.S. Forest Service. The species was listed as endangered under the Endangered Species Act of 1973 on 17 September 1980 (U.S. Fish and Wildlife Service (1980b)). A member of the rose family (Rosaceae), the plant historically occurred at four sites in New Hampshire's White Mountain National Forest and one site in Vermont. Presently, the species is known to exist in one location along the heavily used Appalachian Trail in the Presidential Range of the White Mountains. This population is currently one-quarter of its reported size in the 1930's and remains in danger of further reduction by man-caused and natural factors.

PAST AND PRESENT DISTRIBUTION

Potentilla robbinsiana was discovered by James Robbins in 1829 and later described by William Oakes. In 1819, Abel Crawford constructed the well-known Crawford Path (now a segment of the Appalachian Trail) through the Mt. Monroe colony, one of the four historical locales of P. robbinsiana and the only one known to presently exist (Burt 1960) (Figure 1). Little is known of the population's status and changes during the 1800's, however, collecting for herbariums had some impact. In various New England herbariums, 40 herbarium sheets containing nearly 100 plants are stored (Graber 1980).

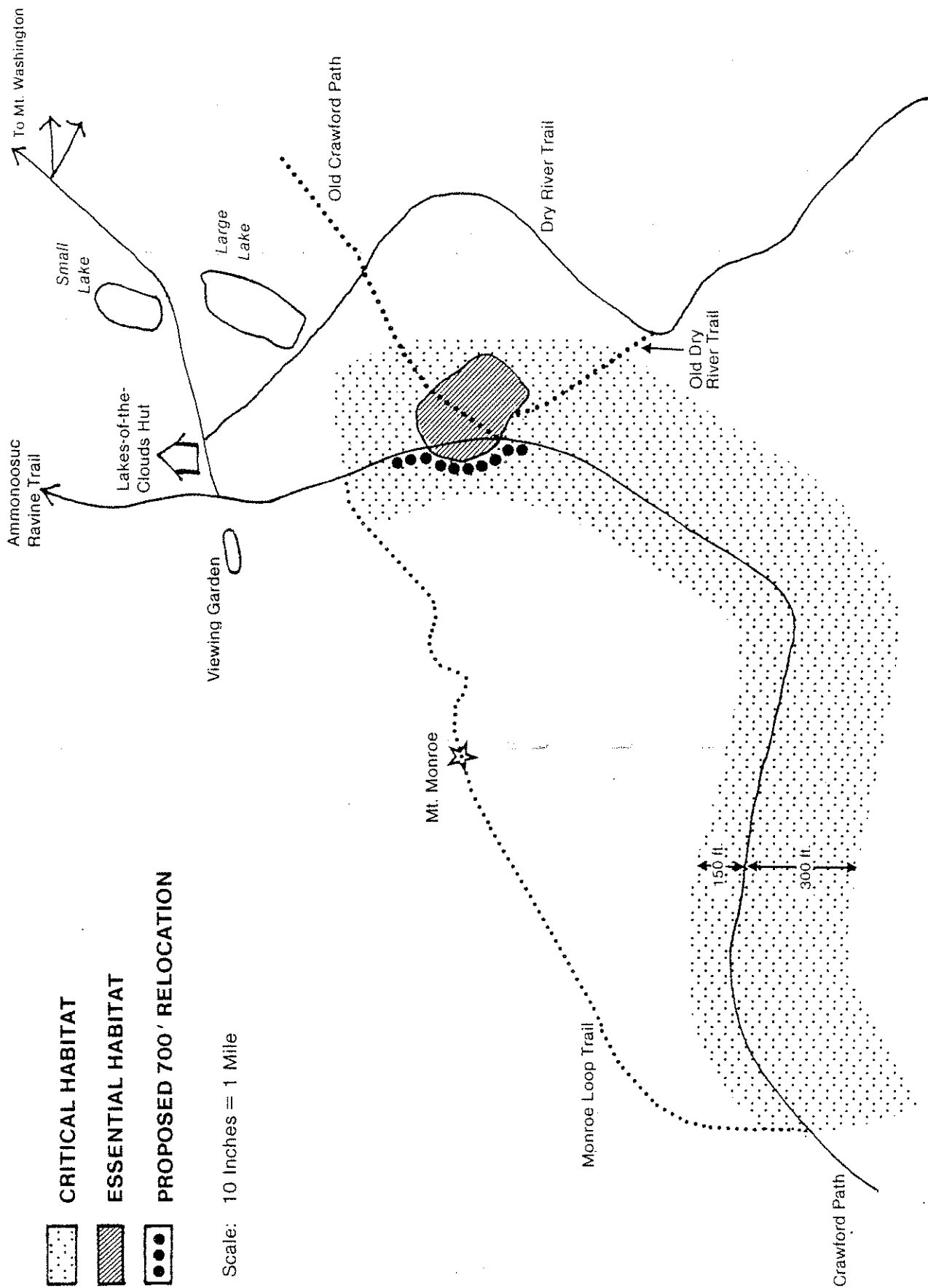


FIGURE 1.

Little was known of the population stability at the main P. robbinsiana colony at Mt. Monroe until recently. Steele (Graber 1980) noted that the population presently occupies about one-quarter of the territory occupied in 1934. S. K. Harris (Graber 1980) observed that plants were growing on both sides of the Crawford Path as recently as 1965. By 1972, plants were absent from the west side of the trail. Presently, the natural population, i.e., excluding transplants, exists only on the east side of the trail. All plants within eight meters of the trail have disappeared with the exception of one.

Graber (1980) mapped the remaining population of P. robbinsiana on Mt. Monroe in 1977. The colony occupied only 1,142 m², about one-tenth of suitable habitat in that site. The population consisted of 3,721 established plants, 52 percent of which were less than 1.4 cm in diameter or nonflowering. An additional 772 newly germinated seedlings were found; 328 remained at the end of the first summer. Therefore, the total plant population was 4,049.

Edward Tuckerman made collections at two locales in 1839, both are now extinct. One collection was taken northeast of the peak of Mt. Washington. However, the Mt. Washington toll road, built in 1861, was constructed through this site. Tuckerman made another collection on Mt. Mansfield, Vermont. No further collections were made from either site (Graber 1980).

In 1897 and 1915, P. robbinsiana was located on Franconia Ridge, New Hampshire (Steele 1964) at a north station by Endicott and a south station by Fernald, respectively. In nearly 65 years, the north station has not been relocated and is felt to be extinct. Steele relocated the south station in 1963. He observed three small clumps of the plant, but subsequent searches,

including extensive surveys in 1977 and 1978, have not relocated any plants (Graber 1980). P. robbinsiana is felt to be extirpated from both sites (Graber 1980).

In 1979, a newly discovered population was reported on private land in Vermont. Subsequent examination proved these plants to be Potentilla norvegica, not P. robbinsiana (Crow, personal communication).

NATURAL HISTORY AND HABITAT REQUIREMENTS

Potentilla robbinsiana is a very low, almost stemless, perennial plant with a dense tuft of leaves above ground and deep taproot underneath. The dense rosette of compound leaves, measuring two to four cm across, consists of toothless leaflets in threes, (Figure 2). New leaf development begins in May. A few flowers, borne on stems one to three cm in length, will begin to bloom during the last week of May. Most flowering will take place during the first week of June and be complete by June 26, peaking between the 10th and 20th. At almost any time until October, scattered blooms may be found (Graber 1980). No plants have been reported flowering with a leaf rosette diameter of less than 1.4 cm.

Mature plants, 50 to 78 percent of which flower each year, produce an average of three flowers each. As many as 30 flowers have been produced by a single large plant. Achenes in the dried flower heads are present by the end of June. Seeds mature in mid to late July. The total seed production of the single colony on Mt. Monroe averages approximately 24,000 viable seeds; the average fruiting plant produces 21 viable seeds. Seed viability is 90.4 percent (Graber 1980).

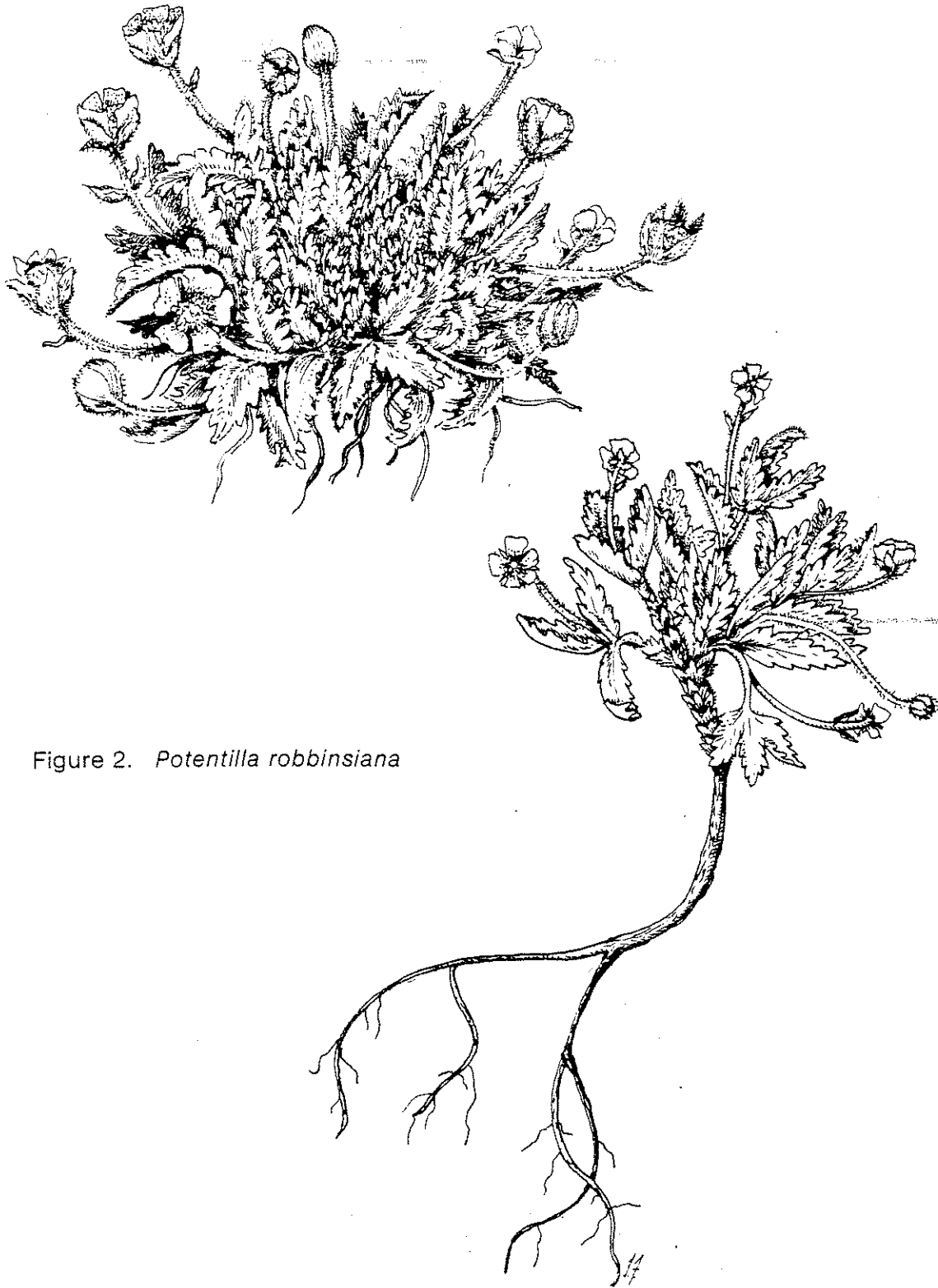


Figure 2. *Potentilla robbinsiana*

Seeds disperse by falling on the ground on dry, windy days. Seeds rarely travel more than a few centimeters; no seedlings have ever been found more than 14 cm from the mother plant. Because of this, plants are slow to spread. Natural reestablishment is very difficult once the plants are extirpated from an area. Germination occurs in June and July. Graber (1980) found that a majority of the seeds produced do germinate but the seedlings die quickly. He reported that up to 800 new seedlings have established themselves during a given summer, but only 40 percent survive until October.

The habitat of the plant can be described as a treeless, nearly barren fell-field above 1,220 m (4,000 ft.) where the climate is extremely harsh. The mean annual temperature in these sites is 10°C and wind speeds average 43 KM/h annually. The substrate is shallow, loamy sand terraces with a stony pavement-like surface (Storks and Crow 1979). The soil is derived from fine-grained mica schist red rock and is weakly calcareous. The stony surface layer protects the soil from blowing or washing away due to high winds or severe storms. The stony pavement is subject to frost heaving every month of the year (Graber 1980).

The minute shelter spots which collect fine soil particles among the stones are the nurseries for newly germinated P. robbinsiana; only here can they become established (Graber 1980). If the substrate is disturbed, soil is blown or washed away. Accordingly, establishment and survival of new plants is extremely difficult.

TAXONOMIC RELATIONSHIPS

Considered an "apomictic segregate from P. hypartica" by Love and Love (1966, cited by Graber 1980), the name Potentilla robbinsiana Oakes subspecies robbinsiana is applied to the Mt. Washington taxon, and subspecies hypartica (Malte) D. Love (= P. hypartica Malte) to the Arctic taxon by D. Love (Storks and Crow 1979).

Type publication: Potentilla robbinsiana Oakes ex. Torrey and Gray a flora of North America 1 (3); 441.1840 (Storks and Crow 1979).

POPULATION LIMITING FACTORS

A variety of man-made and natural causes are responsible for the endangered status of P. robbinsiana. These causes have been recognized in the Federal Register, Vol. 45, No. 58 (USFWS 1980b) and mentioned by various authorities in the field (Graber 1980; Steele 1964; Storks and Crow 1979).

1. The decline of the plant populations at both of the more recently known locales, Mt. Monroe and Franconia Ridge, has been due in part to trampling (Steele 1964; Storks and Crow 1979; Graber 1980; USFWS 1980a; USFWS 1980b). The nearly barren, fell-field habitat which Potentilla robbinsiana occupies is open and offers no obstacle to users of the trail. Plants may actually be trampled and crushed; however, even more damaging to the population is the shifting and dislodging of the stony pavement-like surface. Once this stony pavement-like surface is disturbed by the abrasion and churning caused by users' feet, the soil between the stones which provides Potentilla's habitat is loosened and soon blown or washed away. Once disturbed, these fragile alpine habitats and plant communities take many years to recover.

Public use in the colony areas has occurred for a variety of reasons, discussed in the following:

a. Both locales (Franconia and Mt. Monroe) are located along the Appalachian National Scenic Trail, one of the oldest and most heavily used hiking trails in the United States. Hiker traffic, along with many outdoor recreational activities, has increased in recent years. The segment of trail through the Mt. Monroe colony was constructed by Abel Crawford in 1819. Population reductions have occurred since then due to this choice of location. The Franconia Ridge segment of the trail had similar impacts on the other populations.

Some movement through the Monroe colony is generated by a nearby Appalachian Mountain Club (AMC) mountain hut. The Lakes-of-the-Clouds Hut, with an overnight capacity of 90 guests, is located approximately 200 m away. It is one of eight huts operated by the AMC. It is the oldest mountain hut system in the United States. Many hikers along the southern Presidential Range make a day or overnight visit at the Lakes-of-the-Clouds Hut part of their itinerary.

b. At the Mt. Monroe site, individuals often stop in the area for a break or to stay at the hut. Due to the high and exposed location with outstanding views of numerous mountains; photography, scenery-viewing, or short walks are common activities. An outcrop immediately east of the colony is an excellent outlook and further attracts users into the P. robbinsiana site. These individuals are not actively hiking through the area and, accordingly, are not as likely to follow the trail corridor.

c. The fame of the alpine flora of the White Mountains has been well established. In late June or early July, when much of the flora is in bloom, botanical interest is high. Many hikers come to view the flora. Conservation organizations, botanical clubs, schools, and university groups visit the Mt. Washington area regularly for botanical studies. The remaining population of P. robbinsiana has obvious great appeal and is often sought out. In seeking flora, these individuals will often leave the trail corridor. This impact is not unique to P. robbinsiana and the Mt. Monroe site, but common throughout alpine-tundra areas in the National Forest. Because the significant impact of trampling in the stone substrata, individuals, who might avoid stepping on mature plants, could still disrupt the early regeneration process. The recent increase of concern and the official recognition of P. robbinsiana as endangered could potentially generate more use into the area.

2. The major natural cause of P. robbinsiana loss is the harsh climate of the area where the plant occurs. The small size of the population puts this species in great danger of extinction due to natural fluctuations. Only 40 percent of the seedlings survive each year, and during the first few years after germination, the mortality rate of the plants is very high (Graber 1980). Frost heaving during the spring and fall is the most frequent natural cause of plant death. Many seedlings also die during the hot, dry periods from what is believed to be drought stress. After the first few years, the mortality rate decreases and the plants may survive two or more decades with some plants approaching an age of 40 years (Graber 1980).

This high mortality rate in seedlings and young plants is not unusual in the plant kingdom. However, for a plant already declining in numbers, this impact is more significant. A major natural calamity, such as extremely high winds or severe storm, could drastically reduce the remaining colony.

3. Over-utilization for commercial, scientific or educational purposes has historically and presently impacted the population. Steele (1964) points out that one factor threatening Potentilla robbinsiana is overzealous collecting by botanists. He cites this as the probable cause of the extirpation of one of the Franconia sites. Graber (1980) also notes that the collecting of specimens of Potentilla robbinsiana for herbaria has taken its toll. Graber notes that over 40 herbarium sheets containing nearly 100 plants have been accounted for in various New England herbaria.

4. The inadequacy of existing regulatory mechanisms has allowed some loss of P. robbinsiana. Although Potentilla robbinsiana does appear on state lists which were developed by botanists within New Hampshire and Vermont, no state legislation currently offers it specific protection in either state. The habitat type (alpine areas) of Potentilla robbinsiana is offered some protection by Vermont State Law: Vermont's Land Use and Development Law (Title 10 of Vermont Statutes, Part 5, Chapter 151, Act 250, Subchapter 3, Sec. 6042) does restrict what kinds of development can take place in certain special areas. The rules of the Environmental Board include alpine areas as special areas and they are, therefore, offered some protection. Sec. 6086 of this same Act also requires the consideration of wildlife habitat and endangered species in the permitting of developments or subdivisions (USFWS 1980b).

The United States Forest Service (USFS) regulations governing the land on which this species occurs prohibit removing, destroying, or damaging any plant that is classified as a threatened, endangered, rare or unique species (36 CFR 261.9), (Appendix, Attachment 1). These regulations are difficult to enforce, however.

As of 17 September 1980, P. robbinsiana was listed as Endangered with Critical Habitat (USFWS 1980b). Critical Habitat was determined to include the area on Mt. Monroe where the species occurs, a strip of land 4,066 feet long and 450 feet wide (Figure 1). The Endangered Species Act will offer additional protection to this species.

5. Disease and predation from natural causes does not appear applicable to the decline of this species.

CONSERVATION EFFORTS

The earliest conservation efforts began with concerned botanists, such as Steele and Harris, who observed the declining populations. Through the combined efforts of knowledgeable botanists, USFWS and USFS staff, conservation and botanical groups, actions were initiated to establish special status and protective measures.

Various national legislative actions established the means to insure official recognition and protection of rare flora including P. robbinsiana. Section 12 of the Endangered Species Act of 1973 directed the Secretary of the Smithsonian Institution to prepare a report on those plants considered to be endangered, threatened, or extinct. This report, designated as House Document No. 94-51, was presented to Congress on January 9, 1975. On July 1, 1975, the Director of the U.S. Fish and Wildlife Service published a notice in the Federal Register (40 FR 27823-27924) of his acceptance of the report of the Smithsonian

Institution as a petition within the context of Section 4 (c) (2) of the Act, and of his intention thereby to review the status of the plant taxa named within. On June 16, 1976, the USFWS published a proposed rulemaking in the Federal Register (41 FR 24523-24572) which determined approximately 1,700 vascular plant species to be Endangered species pursuant to Section 4 of the Act. This list of 1,700 plant taxa was assembled on the basis of comments and data received by the Smithsonian Institution and the Service in response to House Document No. 94-51 and the July 1, 1975, Federal Register publication. Potentilla robbinsiana was included in the July 1, 1975, notice of review and the June 16, 1976, proposal (USFWS 1980b).

The Endangered Species Act amendments of 1978 required that all proposals over two years old be withdrawn. A one year grace period was given to proposals already over two years old. On December 10, 1979, the USFWS published a notice withdrawing the June 16, 1976, proposal which had expired. The USFWS had sufficient new information to warrant reproposing Potentilla robbinsiana and proposing Critical Habitat for the first time on March 24, 1980, (USFWS 1980b).

During the early 1970's to the present, various conservation actions to protect the plant were reviewed and enacted. Elimination of the hiker impact was the primary concern. Steele, in a 1978 letter to the White Mountain National Forest (WMNF) Forest Supervisor, proposed moving the Crawford Path to the northwest side of Mt. Monroe, an approximate distance of one-half mile. This action was reviewed by the USFS and concerned public

and professionals through the unit planning process in the Presidential Unit Plan. The final planning decision (USFS 1979) stated:

"Appalachian Trail Management

(6) Lakes-of-the-Clouds Hut

Proposed Action. Relocate one mile of the Dry River Trail to protect Endangered plant species. Conduct interim educational efforts to protect plants. Relocate about one mile of Appalachian Trail if proved ineffective."

At a meeting on May 30, 1979, protective measures for P. robbinsiana were discussed and formulated by United States Forest Service/White Mountain National Forest and Northeast Forest Experiment Station (NEFES) staff, botanists Dr. Garrett Crow and Irene Storks of the University of New Hampshire (UNH), Fred Steele, and Reuben Rajala, Trail Supervisor for the AMC. The minutes of the meeting are found in Appendix 2. In summary, conclusions of the meeting were:

1. Screeing (low rock wall) along the Crawford Path should be built as soon as possible to minimize trampling impact.
2. Signing to alert the public to stay on the trail and of the rare flora should be established. General wording, i.e., nonspecific to P. robbinsiana, should be used to avoid additional attraction to colony site.
3. Educational posters and displays at the Lakes-of-the-Clouds and other huts should be developed. Information slips included with hut reservation forms were also discussed.

4. Hut naturalists and crews should be made aware of the problem and initiate efforts to encourage people to stay out of the colony site.
5. Programs monitoring the use of the Crawford Path would begin in summer of 1979 and be repeated in 1980. Counts would be made of the percentage of users who stay on the screed trail. A 90 percent compliance level, later changed to 95 percent was established as the necessary level to determine effectiveness of protective measures, i.e., screeing and signing.
6. Botanical and recreational evaluation of Crawford Path relocation would be made by USFWS, USFS, AMC and botanists. A tentative corridor would be laid out in summer 1979. There existed differences of opinion as to the need of trail relocation. Some felt relocation was absolutely necessary to save P. robbinsiana. Others felt relocation would not solve the problem and that protective measures mentioned above would significantly modify user impact to the site.
7. Relocation of a segment of the Dry River Trail was discussed and accepted. This trail joins the Crawford Path southeast of the colony (Figure 1). By trail relocation to the north, some reduction of hiker traffic through the P. robbinsiana site would occur. On 7 June 1979, a meeting took place at Monroe Flats to review plans for screeing and evaluate relocation of the Dry River Trail and Crawford Path. Measures were discussed to insure no further site damage due to scree wall construction.

By 22 June 1979, the scree wall was constructed along the Crawford Path in the colony area. Signing with USFS signs (No. P2335, P2337) was done at points above timberline in the area. Concurrently, the relocation site for the Dry River Trail was reviewed and finalized. The trail was relocated in August 1980 by AMC and USFS personnel.

On 17 June 1980, a meeting was held at Lakes-of-the-Clouds Hut to discuss and finalize a proposed Crawford Path relocation; USFWS Endangered Species biologists, Richard Dyer and Irene Storks, USFS and AMC Staff, and Dr. Garrett Crow of the University of New Hampshire were present. All agreed that since the portion of the Critical Habitat that the proposed trail would pass through is a buffer zone with no P. robbinsiana in it, the proposed route was acceptable if relocation became necessary.

In the summer of 1981, a concerted effort was made to protect P. robbinsiana and to provide an educational program to visitors. The Forest Service and AMC placed signs near the Critical Habitat and stationed uniformed patrolmen at the site during the critical flowering period in June. The Appalachian Mountain Club, under contract with the Forest Service and U.S. Fish and Wildlife Service, provided educational talks to guests at the Lakes-of-the-Clouds Hut and performed an intensive study of hiker behavior and volume of use along the Crawford Path near the Potentilla colony. Of the 6,330 hikers counted, approximately 97 percent stayed on the trail as a result of the educational and uniformed patrol effort.

Since the status of Potentilla and the Crawford Path relocation are highly sensitive public issues, a Potentilla Working Group was appointed by the Forest Supervisor of the White Mountain National Forest. The mission of this group was to evaluate the success of the 1979, 1980 and 1981 efforts to protect Potentilla and to develop concerns and suggestions to be incorporated in the Species Recovery Plan, as required by the Endangered Species Act.

This group was formed during the summer of 1981 and consisted of the following:

1. Paul Shaw, District Ranger, U.S. Forest Service, Group Leader
2. Dorothy Taylor, Research Director, Appalachian Mountain Club
3. Reuben Rajala, Trails Supervisor, Appalachian Mountain Club
4. Dr. Harry McDade, Interested citizen
5. George Hamilton, Interested citizen
6. Dr. Peter Marchand, Botanist, Johnson State College, Vermont
7. Dr. Garrett Crow, Botanist, UNH, New Hampshire
8. Dr. Raymond Graber, Botanist, Forest Service Research.

Technical assistance was provided to the group by John Lanier and Roger Collins of the Forest Service and Richard Dyer, Endangered Species Office, U.S. Fish and Wildlife Service.

Work meetings took place on 9/9/81 and 11/18/81. The Potentilla Working Group's proposed actions are presented in Part II of this plan.

RESEARCH EFFORTS

Research efforts have, until recently, been restricted to population surveys. Historical reports by Tuckerman, Fernald, Endicott, Steele, Harris and other botanists provided the basis of comparison to determine population status and trends as discussed above. These reports spurred further interest and concern for the plant.

In 1977 and 1978, a cooperative study between the USFS - WMNF and the UNH-Department of Botany, was done on the status of endangered, threatened, or rare plants of the White Mountain National Forest (Storks and Crow 1979).

P. robbinsiana was recognized as the most critically endangered plant species in New Hampshire. Intensive surveys of the historic Franconia colony sites were done but proved fruitless. Federal listing was strongly recommended.

Graber (1980) mapped the Mt. Monroe population in great detail in 1977. Each plant was located and counted. The work confirmed the extirpation of plants from the west side of the Crawford Path.

In 1967, Harris attempted to establish new colonies by transplanting plants from the Mt. Monroe colony to similar habitat 900 m away. The transplant failed (Graber 1980). Graber (1980) collected seeds in July 1973 and germinated them in a greenhouse in February 1974. Styrofoam blocks with 40 to 125 cc planting cavities were filled with soil of equal parts of peat, vermiculite and perlite. Weekly fertilization was done. By mid-June, the plants were three to five cm in diameter, the size of the natural plants on Mt. Monroe after a decade of growth. In late June and July, transplanting to Mt. Washington was done. Eighteen plantings in different sites were made to provide a range of environmental conditions of varying aspect, elevation, and plant competition.

Because most losses of mature plants occur during the dormant season, mortality during the first summer was very low. However, after three years, heavy mortality had occurred at some sites. On warmer, dryer and less foggy sites at lower elevations, survival was nil. On the cool, foggy northwestern slopes, survival was poor. The transplants did best on barren stony sites, where conditions were most similar to its natural habitat. They averaged 65 percent success, ranging from 17 percent to 90 percent. Many are now producing flowers, seeds and seedlings.

In the summer of 1980, a cooperative study was started by UNH, USFS, USFWS, NEFES, and AMC to survey and map potential suitable habitat for P. robbinsiana. A combination of ecological characteristics similar to those of the Mt. Monroe site was sought. A geologist surveyed and mapped potential areas for transplanting efforts. The results of this work is in the Appendix (Attachment 2). Further survey efforts are being planned.

A user monitoring program, proposed at the 30 May 1979 meeting, was started in a limited capacity the summer of 1979. Surveys took place on 10 days. However, due to staff and budget limitations, the monitoring was not as complete as desired.

During the summer of 1980, two researchers worked full time from the end of May to August evaluating user activities and level of compliance with screening and signing protective measures. The typical schedule was to count, weather permitting, six to eight hours per day on weekends and on two or three mid-weekdays. All major vacation periods, such as July 4th and Memorial Day were surveyed. Automatic trail counters at three locations on the Crawford Path near the P. robbinsiana site were used. These counters supplemented data during unstaffed days. Although the automatic counters were not highly

accurate in actual counts, they were useful as indices of activity. Visitor information gathered included counts, time of day, direction of travel, size of group, sex, age and intent, such as hiking, botanizing and random wandering. The staff interviewed some noncompliers who left the trail. A similar but more intensive study was conducted during the summer of 1981 by the Appalachian Mountain Club.

PART II
RECOVERY

Primary Objective.

The primary objective of this plan is to protect the existing colony of Potentilla robbinsiana in its entirety, encourage its natural expansion and establish self-sustaining, reproducing populations in at least four identified potential habitats not presently occupied. Once these targets are met, the present endangered status of the plant will be reviewed and changed to threatened or removed from the list if determined feasible.

Specific measures that lead to accomplishment of the primary objective are identified in the following Step-down Outline. This section is divided into two parts; one dealing with the plant's biology and habitat requirements, the other dealing with human use factors which affect the plant. The tasks which were recommended by the Potentilla robbinsiana Working Group are further described in the Step-down Outline Narrative..

STEP-DOWN OUTLINE

Plant Biology and Habitat

1. Determine viability of Potentilla robbinsiana.
 - 1.1 Determine current population.
 - 1.2 Monitor population dynamics.
 - 1.3 Assess minimum viable population size.
2. Refine and document propagation and transplantation techniques.
3. Determine habitat characteristics and requirements.
 - 3.1 Describe present habitat including results of physical and chemical analysis.
 - 3.2 Develop criteria and select transplantation sites.
 - 3.3 Repopulate vacant acceptable habitats.
 - 3.4 Develop public viewing area.
 - 3.5 Monitor for habitat deterioration.

Human Use Factors

4. Reduce or eliminate human use damage to existing plants and habitat or potential habitat.
 - 4.1 Define essential habitat boundaries.
 - 4.2 Relocate the Crawford Path.
 - 4.3 Close essential habitat to all uses.
 - 4.4 Construct a scree wall around essential habitat.
 - 4.5 Sign essential habitat area.
 - 4.6 Define new Dry River Trail more clearly.
 - 4.7 Eliminate any plant collecting.
5. Continue information and education program.
 - 5.1 Contact trail users and enforce regulations.
 - 5.2 Continue educational activities at AMC huts.
 - 5.3 Develop news releases, articles and maintain contact with interested groups.
 - 5.4 Develop a Recreation Opportunity Guide.
6. Monitor hiker activity patterns.
7. Annual report of all activities and results.

STEP-DOWN OUTLINE NARRATIVE

1. Determine viability of Potentilla robbinsiana.

1.1 Determine current population.

Within the Monroe Flats fell-field habitat, all mature flowering and nonflowering plants as well as newly germinated seedlings will be accurately counted. The results of the survey will be directly compared with the existing five-year old data base. The possible recolonization of Potentilla on the abandoned sections of the Crawford Path and Dry River trails within the fell-field will be specifically investigated. An accurate tabulation of the total population will be repeated at five year intervals.

1.2 Monitor population-dynamics.

Detailed quantitative analyses will be conducted within selected permanently marked quadrats. All flowering, nonflowering and seedling Potentilla plants within each quadrat will be accurately plotted and periodically monitored throughout the growing season. Permanent plots will also be established to monitor total vegetative composition and dominance within the Potentilla colony. Quadrat studies will be conducted annually for a five year period.

1.3 Assess minimum viable population size.

The population dynamics information developed in Tasks 1.1 and 1.2 will be evaluated in reassessing the minimum required size for a self-sustaining Potentilla colony. Existing computer analysis techniques and population models developed for other alpine plants will be used where applicable.

2. Refine and document propagation and transplantation techniques.

Much of this research has been completed. The materials and methods for artificial propagation and transplantation need to be documented in an instructional format. Detailed guidance and site selection criteria are necessary to assist in successfully establishing additional cinquefoil colonies.

3. Determine habitat characteristics and requirements.

- 3.1 Describe present habitat including results of physical and chemical analysis.

Detailed soil analysis for specific physical and chemical parameters will be conducted within the existing Potentilla colony. Surficial geology and morphological processes will also be characterized.

- 3.2 Develop criteria and select transplantation sites.

Existing knowledge as well as information gained in previously described tasks will be used to select potential transplantation sites. Factors to be assessed at a minimum include surficial morphology and geology, slope, exposure, associated vegetation, and soil analysis data. Sites identified in the 1980 preliminary investigation will be specifically evaluated.

- 3.3 Repopulate vacant acceptable habitats.

Plants propagated from seed in research facilities will be transplanted to four selected transplantation sites. The growth and reproduction of these transplants will be closely monitored for at least a 10 year period.

3.4 Develop public viewing area.

Plants propagated from seed will be used to establish a public viewing area. The site will be easily accessible and assist in eliminating random searches throughout the essential habitat by interested individuals. The viewing area will also be used to assist the ongoing information/education program. Annual maintenance and further transplants will be conducted as necessary.

3.5 Monitor for habitat deterioration.

Habitat parameters developed in Tasks 3.1 and 3.2 will be periodically monitored for the existing Potentilla colony and four transplant sites. Habitat deterioration might be due to natural climatic change and associated geo-morphological processes, encroachment of other alpine vegetation and/or human use factors.

Human Use Factors

4. Reduce or eliminate human use damage to existing plants and habitat or potential habitat.

4.1 Define essential habitat boundaries.

To more accurately define the physical limits of essential habitat for the existing Potentilla colony, a proposed boundary will be flagged, ground checked and then finalized. The flagged area will also include an appropriate buffer zone.

4.2 Relocate the Crawford Path.

A segment of the Crawford Path which currently bisects the Potentilla essential habitat will be relocated around the west side (+ 700 feet) of the area delineated in Task 4.1. The proposed relocation will be flagged and surveyed to avoid damaging any rare plants. Once approved the new trail will be constructed and marked with scree wall. Approximately 400 feet of the presently existing path will then be obliterated as best as possible.

4.3 Close essential habitat to all uses.

A closure order for approximately three acres of essential habitat will be written and incorporated into White Mountain National Forest regulations. The closure order will be initiated upon completion of trail relocation and screening.

4.4 Construct a scree wall around essential habitat.

The area of essential habitat flagged and surveyed in Task 4.1 will be delineated with scree wall where public entry is most likely. A buffer zone will be included.

4.5 Sign essential habitat area.

Perimeter signs designating the marked area as closed to public use will be erected and maintained.

4.6 Define new Dry River Trail more clearly.

The recently relocated segment of the Dry River Trail will be improved with signs, scree wall, cairns, etc., to more clearly define the trail and eliminate or reduce the observed hiker confusion.

4.7 Eliminate any plant collecting.

The Endangered Species Act Amendments of 1982 prohibit the taking of endangered or threatened plants on federal lands unless the activity is specifically authorized. Permits will be issued to appropriate personnel directly involved in approved recovery actions. Any other activities will be unauthorized and regulations will be strictly enforced.

5. Continue information and education program.

5.1 Contact trail users and enforce regulations.

Uniformed Forest Service back country patrols and AMC personnel will continue to contact trail hikers in a manner similar to the 1981 information/education program. During the Potentilla flowering period, Forest Service personnel will conduct daily patrols. Less frequent visits will be made during the remainder of the summer. All patrols will coincide with periods of high visitor activity as determined by previous hiker behavior monitoring studies.

5.2 Continue educational activities at AMC huts.

Hut crews will be an integral part of the public education program. Crews will be briefed each year regarding the ongoing information/education program and receive extra training as appropriate. Informational signs including wall displays will be developed. Evening talks to all guests, conducted tours and informational walks will be continued.

- 5.3 Develop news releases, articles and maintain contact with interested groups.

All articles generated by members of the Working Group which are designed for release to the general public (not to include articles prepared for scientific publication) will be coordinated through the Public Information Officer of the White Mountain National Forest. A contact list will be developed and the summary of each annual report, new regulations and other items of interest concerning Potentilla will be sent annually to all on the list.

- 5.4 Develop a Recreation Opportunity Guide.

A Recreation Opportunity Guide related to the protection of Potentilla will be developed for interested visitors.

6. Monitor hiker activity patterns.

The effectiveness of the information/education program and other measures to protect Potentilla and its essential habitat, i.e., trail relocation, signing, new scree walls, etc., will be evaluated by monitoring hiker activity within the immediate area. Stationed observers and self-recording instruments will continue to be used to monitor activity patterns and compliance rates. The effectiveness of the information/education program and other protective actions will be evaluated annually and refined or improved as necessary.

7. Annual report on all activities and results.

An annual report on the results and progress of all activities identified in this plan will be prepared and submitted to the Working Group and other interested parties.

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PART III
IMPLEMENTATION SCHEDULE

The ultimate purpose of this plan is to stabilize or increase the existing population of P. robbinsiana and establish four additional, self-sustaining colonies. In order to do this, certain tasks must be carried out in chronological order so that as one set of tasks is completed, the information may be used to implement the next set of tasks.

The sequence of this implementation schedule is designed to initially produce baseline data on human use factors as well as data on habitat parameters and the basic biology of the plant. Once the baseline data is established, other activities, such as transplants into suitable habitat, monitoring programs, trail relocation, etc., are initiated and carried out throughout the planning period. Other tasks, such as public education, compliance monitoring and backcountry patrol are emphasized at the beginning of the plan's implementation. As the public becomes more aware of the program and the compliance rate increases over time, these tasks will decrease in magnitude. Toward the end of the planning period, it is assumed that most or all of the acceptable habitat will have been repopulated. These populations will be closely monitored. The trails, scree walls and signs will be on a maintenance schedule, and human use monitoring and educational efforts will be reduced. The eventual program is foreseen to be one of periodic monitoring of the plant population, low level prevention of human disturbance and sign and trail maintenance.

IMPLEMENTATION SCHEDULE

PHASE: Agency Draft

General Category	Plan Task	Task No.	Priority	Duration	Responsible Agency or Organization	FY 1	FY 2	FY 3	FY 4	FY 5	Comments
I1	Determine current population	1.1	1	1 year	USFWS	1,000					Ongoing
I6	Monitor population dynamics	1.2	1	5 years	USFWS	2,500	2,500	2,500	2,500	2,500	
I1	Assess minimum population size	1.3	1	1 year	USFWS			1,500			Initial assessment in 1982
R7	Document propagation and translocation techniques	2.0	2	1 year	NEPES	500					
I3	Describe present habitat	3.1	2	2 years	USFWS	2,500	2,500				
I3	Develop site selection criteria	3.2	2	1 year	USFWS		500				
M1	Repopulate acceptable habitats	3.3	3	3 years	USFWS			1,500	1,500	1,500	
O1	Develop viewing area	3.4	1	1 year	NEPES/WMNF	250	250	250	250	250	Ongoing
I2	Monitor habitat deterioration	3.5	3	5 years	USFWS	500		500		500	
M3	Define essential habitat	4.1	1	1 year	WMNF	500					
M7	Relocate Crawford Path	4.2	1	1 year	WMNF		3,700				
O3	Close essential habitat	4.3	1	1 year	WMNF		350				Administrative action
M7	Construct scree wall	4.4	1	1 year	WMNF		3,500				

IMPLEMENTATION SCHEDULE

PHASE: Agency Draft

General Category	Plan Task	Task No.	Priority	Duration	Responsible Agency or Organization	FY 1	FY 2	FY 3	FY 4	FY 5	Comments
O3	Sign essential habitat	4.5	1	1 year	WMNF		500				
M7	Define Dry River trail	4.6	1	1 year	WMNF	1,250					
O2	Eliminate any collecting	4.7	1	5 years	WMNF						Enforce- ment action
O1	Contact trail users	5.1	1	5 years	WMNF/AMC	4,000	4,000	4,000	4,000	4,000	Ongoing
O1	Continue educational activities	5.2	1	5 years	AMC/USFWS	2,500	2,500	2,500	2,500	2,500	Ongoing
O4	News releases, articles, etc.	5.3	3	1 year	WMNF	1,000	1,000	1,000	1,000	1,000	Adminis- trative action
O4	Develop recreation guide	5.4	1	1 year	WMNF	500					Ongoing
O1	Monitor hiker activity	6.0	2	2 years	USFWS/AMC		2,500		2,500		Ongoing
O4	Annual report	7.0	2	5 years	WMNF/USFWS	1,000	1,000	1,000	1,000	1,000	Adminis- trative action

USFWS - United States Fish and Wildlife Service
 NEHFS - Northeast Forest Experiment Station
 WMNF - White Mountain National Forest
 AMC - Appalachian Mountain Club

APPENDIX A

LIST OF REVIEWER ORGANIZATIONS

U.S. Forest Service
White Mountain Natural Forest
Laconia, New Hampshire

U.S. Forest Service
Northeastern Forest Experiment Station
Durham, New Hampshire

University of New Hampshire
Department of Biology and Plant Pathology
Durham, New Hampshire

Appalachian Mountain Club
Northern New England Regional Office
Gorham, New Hampshire

Johnson State College
Division of Environmental
and Scientific Studies
Johnson, Vermont